

## 299-W18-169 (A7651) Log Data Report

### Borehole Information:

<b>Borehole:</b> 299-W18-169 (A7651)		<b>Site:</b> 216-Z-1A Crib			
<b>Coordinates (WA St Plane)</b>		<b>GWL<sup>1</sup> (ft):</b> None	<b>GW Date:</b> 03/31/06		
<b>North</b> 135,369.787 m	<b>East</b> 566,562.41 m	<b>Drill Date</b> 09/77	<b>Ground Level Elevation</b> 675.29	<b>Total Depth (ft)</b> 127.0	<b>Type</b> Cable

### Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Steel	2.4	8 5/8	8	5/16	2.4	127

### Borehole Notes:

The logging engineer measured the casing stick-up and diameter using a caliper and steel tape. Logging data acquisition is referenced to the TOC. According to the driller's log, contamination was encountered between 34 and 47 ft; a carbon tetrachloride odor existed at 93 ft and from 113 to 115 ft. Perforations in the casing are reported to have been made from 96 to 126 ft. Grout is reported to be emplaced around the 8-in. casing at unknown depths near the ground surface.

### Logging Equipment Information:

<b>Logging System:</b>	Gamma 1E		<b>Type:</b>	SGLS (70%) SN: 34TP40587A
<b>Effective Calibration Date:</b>	05/02/06	<b>Calibration Reference:</b>	DOE/EM-GJ1200-2006	
		<b>Logging Procedure:</b>	GJO-HGLP 1.6.5, Rev. 1	

<b>Logging System:</b>	Gamma 4H		<b>Type:</b>	NMLS SN: H310700352
<b>Effective Calibration Date:</b>	03/06/06	<b>Calibration Reference:</b>	DOE/EM-GJ1154-2006	
		<b>Logging Procedure:</b>	GJO-HGLP 1.6.5, Rev. 1	

<b>Logging System:</b>	Gamma 4I		<b>Type:</b>	PNLS SN: 01754
<b>Effective Calibration Date:</b>	Not Required	<b>Calibration Reference:</b>	None	
		<b>Logging Procedure:</b>	GJO-HGLP 1.6.5, Rev. 1	

### Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3 Repeat	4 Repeat
Date	07/10/06	07/11/06	07/11/06	07/11/06
Logging Engineer	McClellan	McClellan	McClellan	McClellan
Start Depth (ft)	60.0	127.0	45.0	30.0
Finish Depth (ft)	3.0	59.0	33.0	18.0
Count Time (sec)	100	100	100	100
Live/Real	R	R	R	R

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Log Run	1	2	3 Repeat	4 Repeat
Shield (Y/N)	N	N	N	N
MSA Interval (ft)	1.0	1.0	1.0	1.0
ft/min	N/A <sup>2</sup>	N/A	N/A	N/A
Pre-Verification	AE172CAB	AE173CAB	AE173CAB	AE173CAB
Start File	AE172000	AE173000	AE173069	AE173082
Finish File	AE172057	AE173068	AE173081	AE173094
Post-Verification	AE172CAA	AE173CAA	AE173CAA	AE173CAA
Depth Return Error (in.)	-0.5	N/A	N/A	N/A
Comments	No fine-gain adjustment.	No fine-gain adjustment.	No fine-gain adjustment.	No fine-gain adjustment.

**Neutron Moisture Logging System (NMLS) Log Run Information:**

Log Run	5	6	7 Repeat	
Date	07/12/06	07/13/06	07/13/06	
Logging Engineer	Spatz	Spatz	Spatz	
Start Depth (ft)	2.5	74.0	70.0	
Finish Depth (ft)	75.0	127.0	90.0	
Count Time (sec)	15	15	15	
Live/Real	R	R	R	
Shield (Y/N)	N	N	N	
Sample Interval (ft)	0.25	0.25	0.25	
ft/min	1.0	1.0	1.0	
Pre-Verification	DH132CAB	DH142CAB	DH142CAB	
Start File	DH132000	DH142000	DH142213	
Finish File	DH132290	DH142212	DH142293	
Post-Verification	DH132CAA	DH142CAA	DH142CAA	
Depth Return Error (in.)	0	0	- 1.5	
Comments	None	Equipment malfunction between files -012 and -027	None	

**Passive Neutron Logging System (PNLS) Log Run Information:**

Log Run	8	9 Repeat		
Date	07/13/06	07/13/06		
Logging Engineer	Spatz	Spatz		
Start Depth (ft)	30.0	33.0		
Finish Depth (ft)	45.0	40.0		
Count Time (sec)	60	60		
Live/Real	R	R		
Shield (Y/N)	N	N		
MSA Interval (ft)	1.0	1.0		
ft/min	N/A	N/A		
Pre-Verification	DI402CAB	DI402CAB		
Start File	DI402000	DI402016		
Finish File	DI402015	DI402023		
Post-Verification	DI402CAA	DI402CAA		
Depth Return Error (in.)	N/A	- 1		
Comments	None	None		

**Logging Operation Notes:**

Logging was conducted with a centralizer on each sonde and measurements are referenced to top of casing. Repeat data with the SGLS were acquired at a 200 second counting time from 33 to 45 ft to provide additional detail of the highest activity zone. The NMLS sonde malfunctioned during logging between 77 and 81 ft. Repeat data were acquired from 70 to 90 ft and are substituted for the missing data.

**Analysis Notes:**

<b>Analyst:</b>	Henwood	<b>Date:</b>	08/18/06	<b>Reference:</b>	GJO-HGLP 1.6.3, Rev. 0
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Pre-run and post-run verifications for the logging systems were performed before and after each day's data acquisition. The acceptance criteria were met.

A casing correction for 5/16-in.-thick casing was applied throughout the borehole for the SGLS.

SGLS spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with an EXCEL worksheet template identified as G1EMay06.xls using an efficiency function and corrections for casing and dead time as determined from annual calibrations. The NMLS count rate data were converted to volumetric moisture according to calibration data for an 8-in. borehole. The passive neutron logging system data are used for qualitative purposes and does not require a calibration.

**Results and Interpretations:**

Cs-137 is detected at 4 ft at 0.2 pCi/g.

Np-237 is detected with the SGLS by measuring a daughter product (protactinium-233 (Pa-233)) that emits a prominent gamma ray at an energy of 312.17 keV. Np-237 was detected between 35 and 42 ft. The maximum concentration is approximately 2 pCi/g at a 38 ft depth.

Pu-239, a common contaminant in the 216-Z-1A crib, is not detected above an MDL of approximately 15,000 pCi/g in this borehole.

Gamma rays at energies of approximately 99 and 103 keV were detected between 35 and 41 ft. These energy peaks are below the range of the SGLS calibration, which is approximately 186 to 2615 keV and cannot be quantified. Although there are numerous energy peaks below 186 keV that can be attributed to transuranic radionuclides, it appears likely that these energy peaks can be attributed to Am-241. Am-241 gamma rays occur at 98.97 and 102.98 keV with yields of approximately E-04. The more energetic 662 and 722 gamma rays are normally used to assay Am-241 in steel cased boreholes. However, these gamma rays are not observed in spectra from this borehole, probably because the yields for these gamma rays are two orders of magnitude less than those at 99 and 103 keV. Therefore, it is postulated that Am-241 exists at concentrations less than the MDL of the 722 energy peak of approximately 50,000 pCi/g. The existence of Am-241 at relatively low concentrations is consistent with low concentrations observed for Pa-233 (Np-237) since Np-237 is a decay product of Am-241.

Passive neutron logging was performed in the borehole from 30 to 45 ft. This logging method has been shown to be effective in qualitatively detecting zones of alpha-emitting contaminants from secondary neutron flux generated by the ( $\alpha$ ,n) reaction and may indicate the presence of  $\alpha$ -emitting nuclides, including transuranic radionuclides, even where no gamma emissions are available for detection above the MDL. The passive neutron signal depends on the concentration of  $\alpha$  sources, and also the concentrations of lighter elements such as N, O, F, Mg, Al, and Si which emit neutrons after alpha capture. The passive neutron log indicated a maximum count rate of 0.8 counts per second (cps) at 36 ft. This count rate can be contrasted with that observed in other boreholes in the 216-Z-1A cribs where the count rates can exceed

2000 cps. Part of the reason for the lower count rate is the lower concentrations of transuranics, thus less alpha activity, relative to other boreholes. It is likely Pu does not exist, is at low concentrations, and/or does not exist as a fluoride compound. F-19 has a much higher capture cross section for alpha particles, compared to other light elements such as oxygen or nitrogen, and has been detected in other high count rate boreholes.

A comparison plot of the 1993 and 1998 RLS (operated by Westinghouse Hanford Company and Waste Management Federal Services NW, respectively) spectral gamma data and 2006 SGLS data is included. There is generally good agreement in the assays for Cs-137 and Pa-233. The slight discrepancies in concentrations for Pa-233 are believed to result from the less efficient detectors and insufficient counting times for the 1993 and 1998 RLS data. The relative efficiencies of the 18, 35, and 70 percent detectors are exhibited by the total gamma plot. Radionuclides at or below the MDL of the more efficient SGLS detector may not be quantified accurately by less efficient detectors. Although not quantifiable, the current analysis for the SGLS data suggests Am-241 exists, which was not considered in the RLS analysis. The total gamma profiles suggest no significant changes since 1993.

Moisture data indicate some variability. Between the ground surface and approximately 23 ft, the data are reflecting grout placed around the 8-in. borehole.

The SGLS, NMLS, and PNLS repeat logs all show good repeatability.

**List of Log Plots:**

Depth Reference is top of casing

Depth Scale – 20 ft/inch except for repeat logs

Man-Made Radionuclide Plot

Natural Gamma Logs

Combination Plot

Total Gamma & Moisture

Total Gamma & Dead Time

SGLS/RLS Man-made Comparison Plot

Repeat Section of Man-made Radionuclide

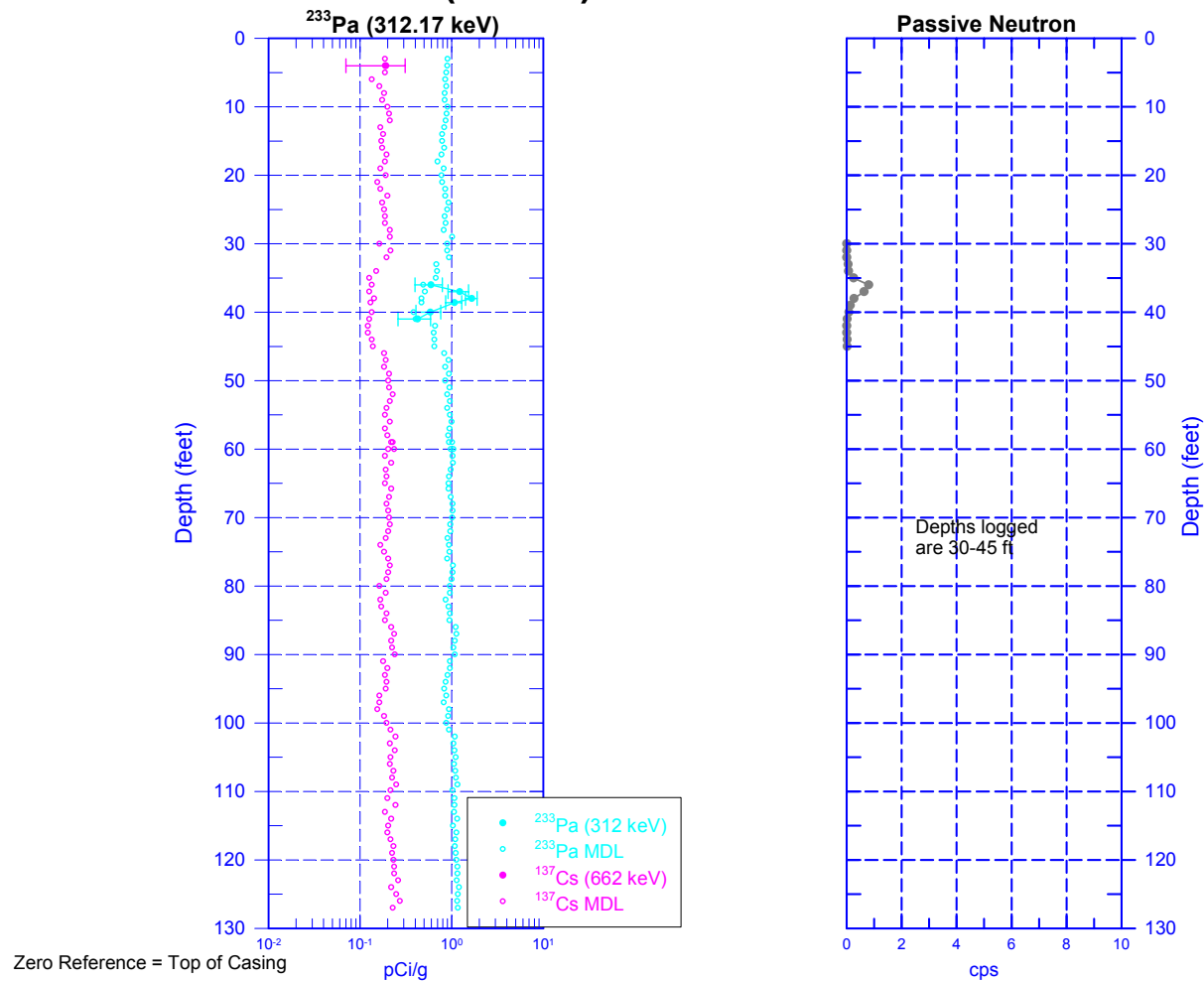
Repeat Section for Natural Gamma Logs

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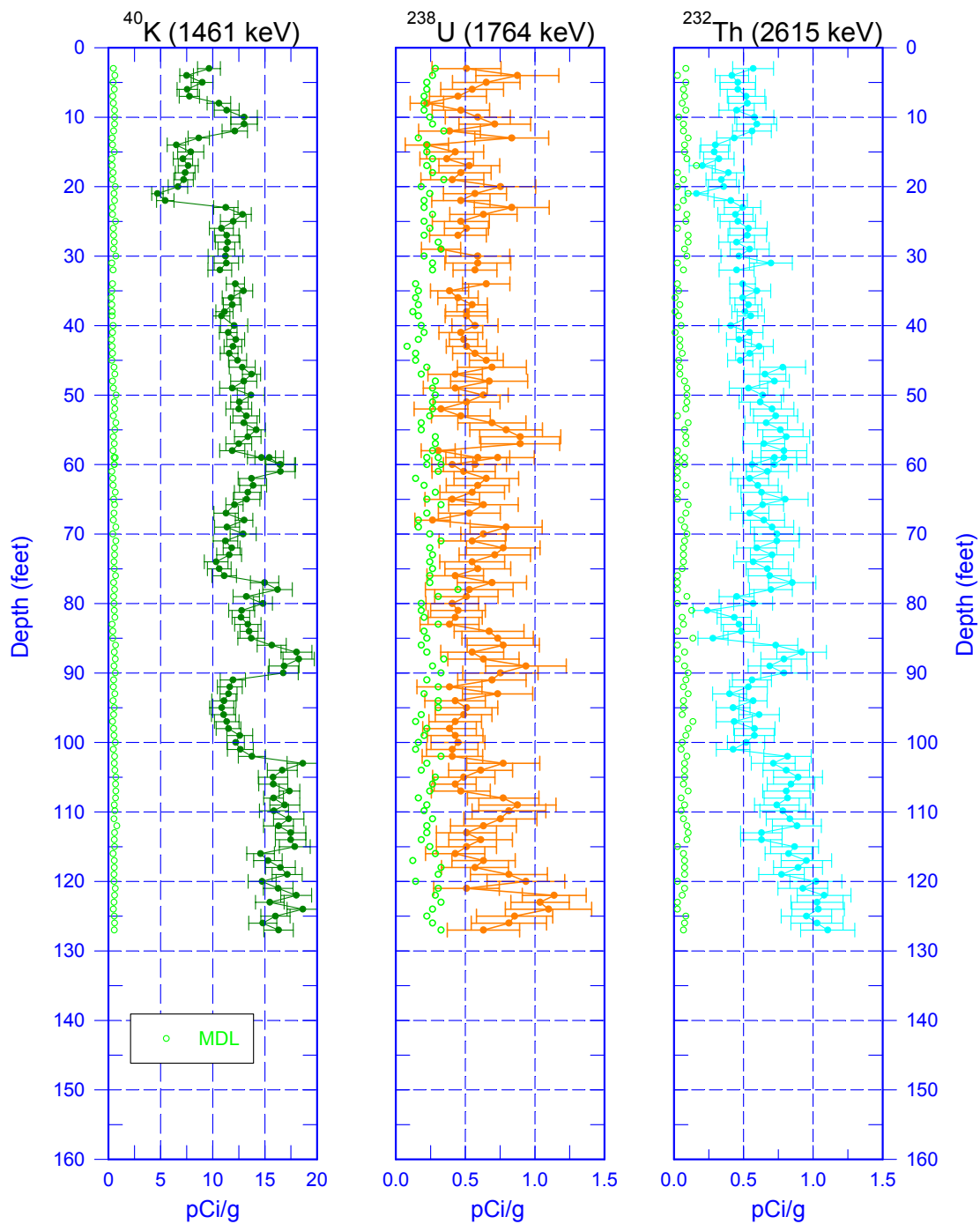
<sup>1</sup> GWL – groundwater level

<sup>2</sup> N/A – not applicable

## 299-W18-169 (A7651) Man-made Radionuclide Plot

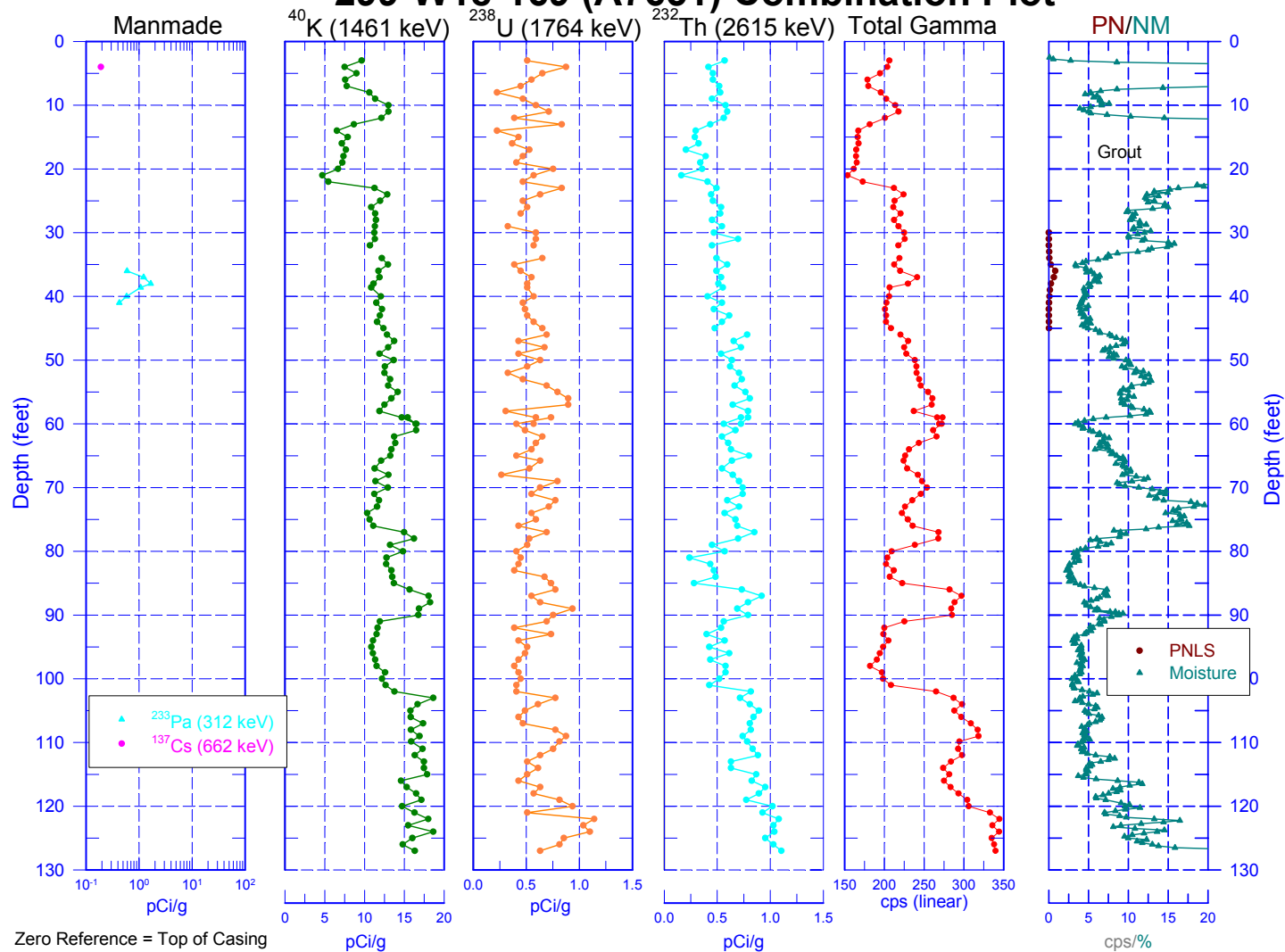


## 299-W18-169 (A7651) Natural Gamma Logs

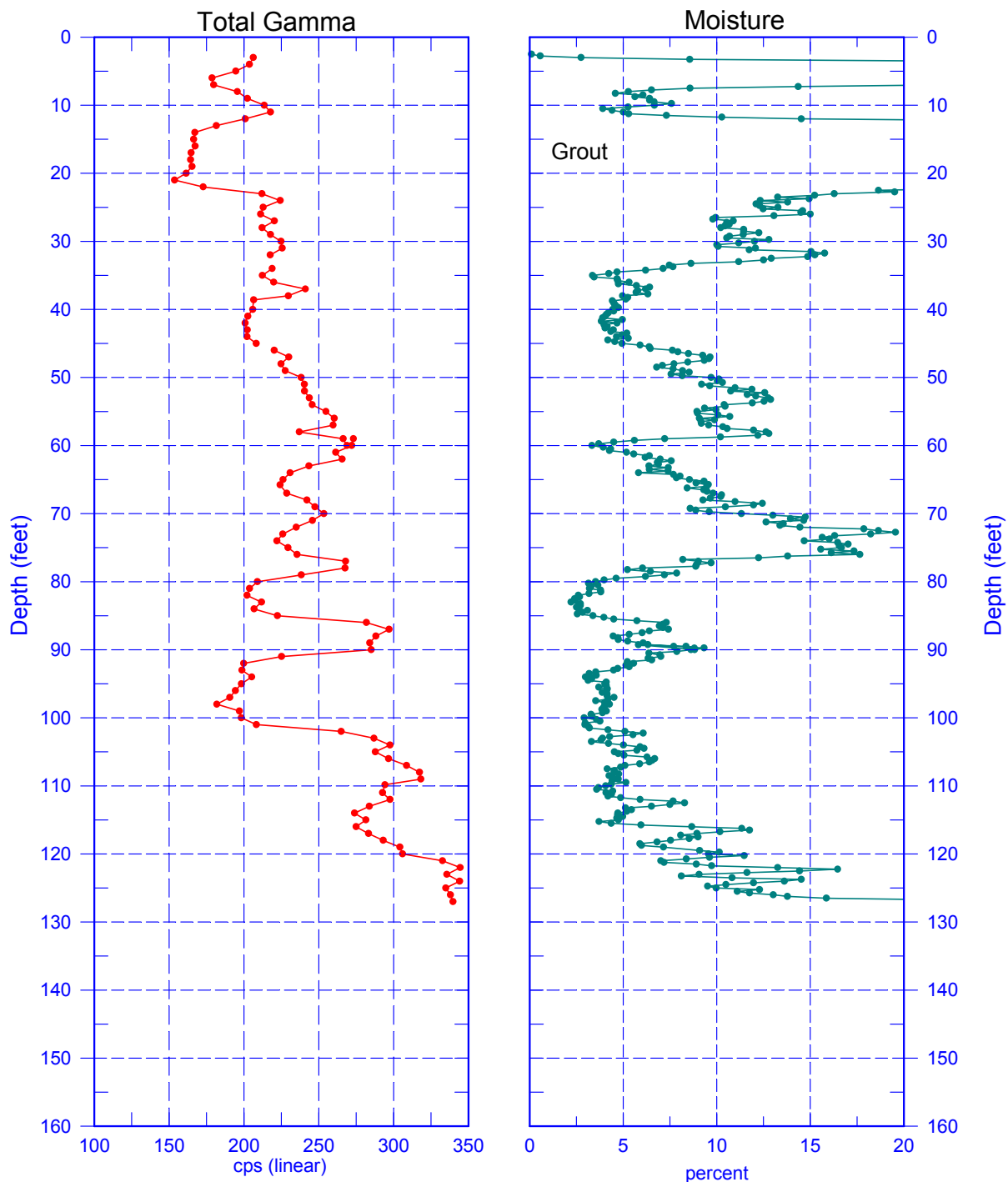


Zero Reference = Top of Casing

## 299-W18-169 (A7651) Combination Plot

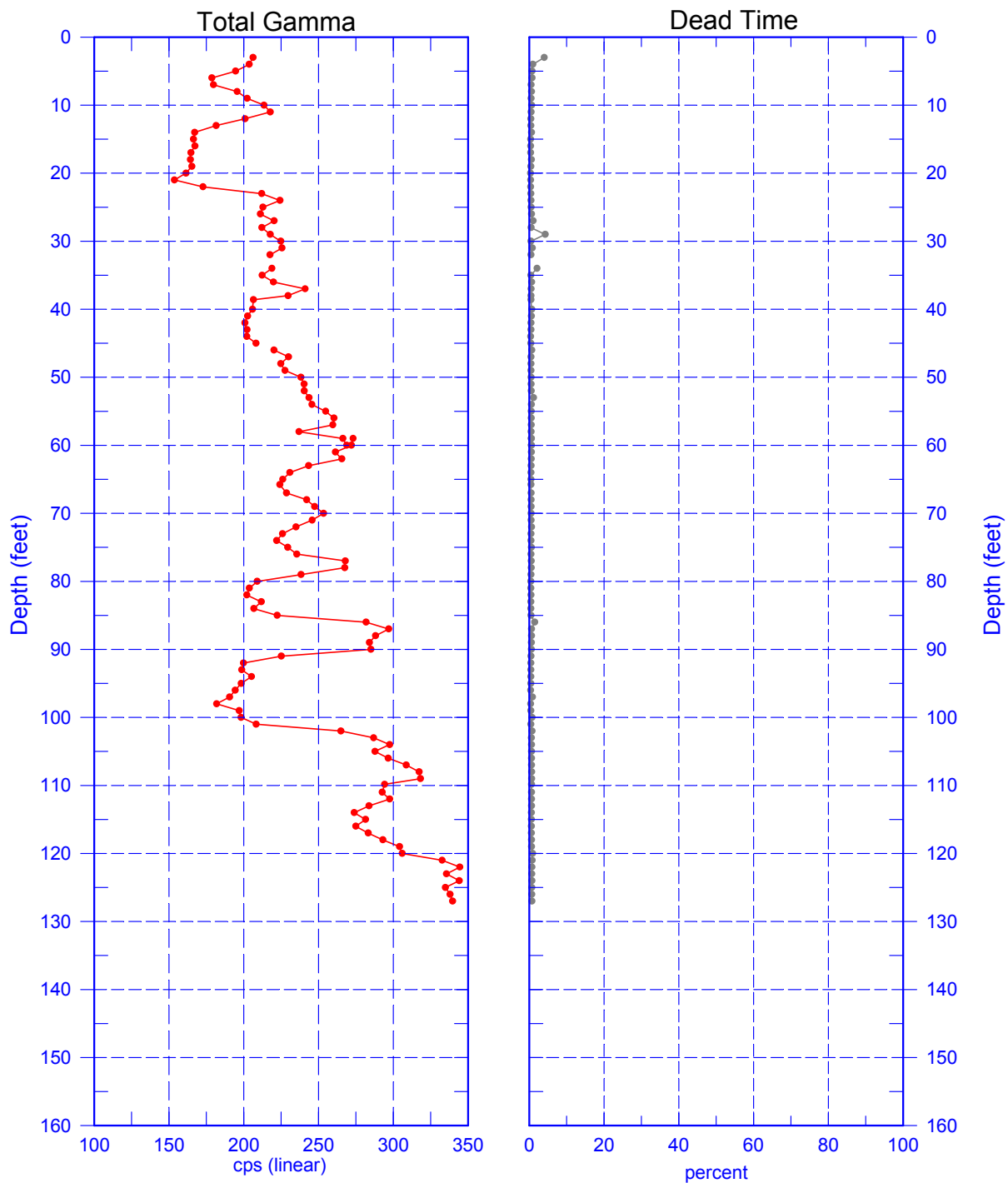


## 299-W18-169 (A7651) Total Gamma & Moisture



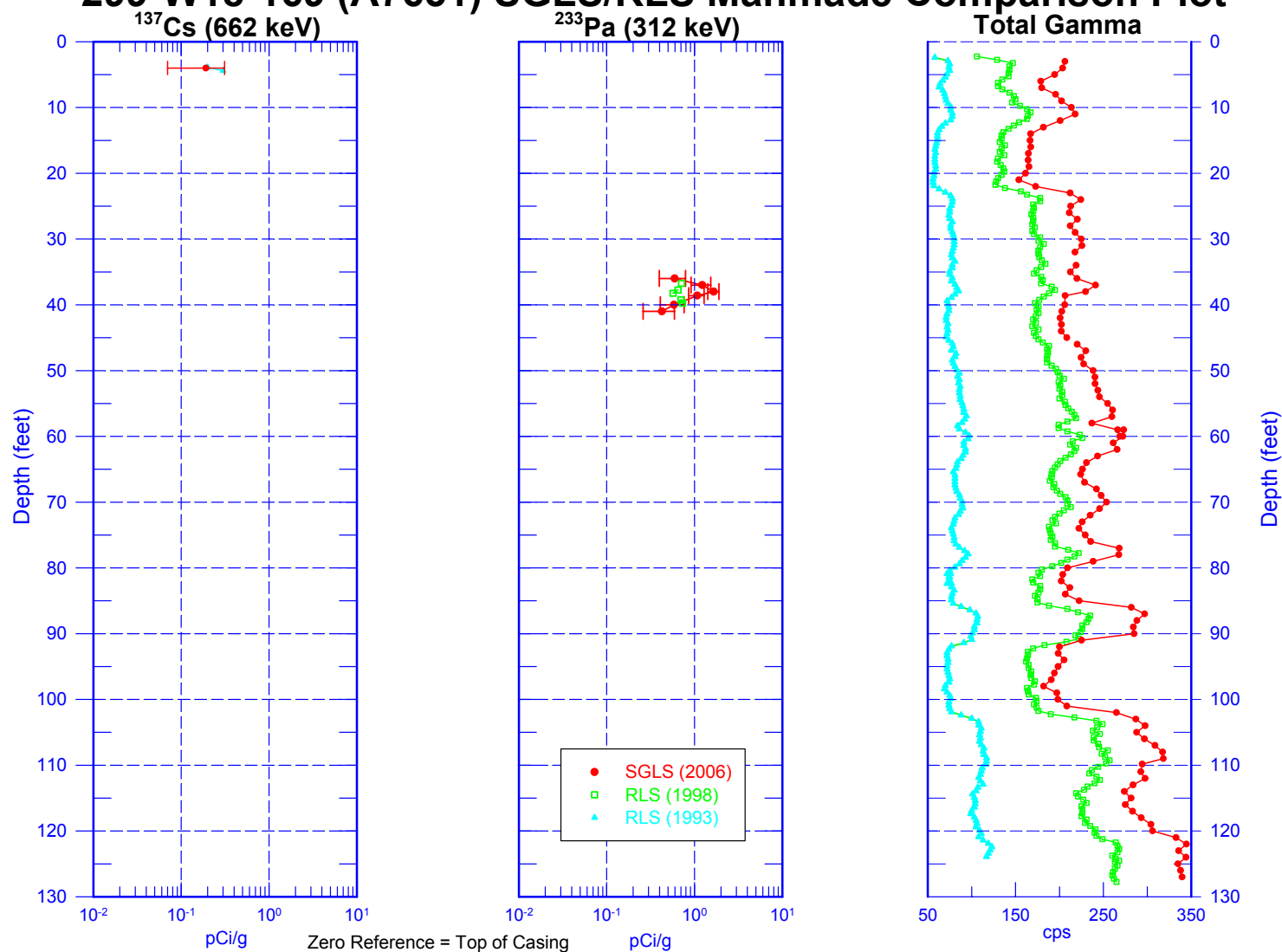


## 299-W18-169 (A7651) Total Gamma & Dead Time

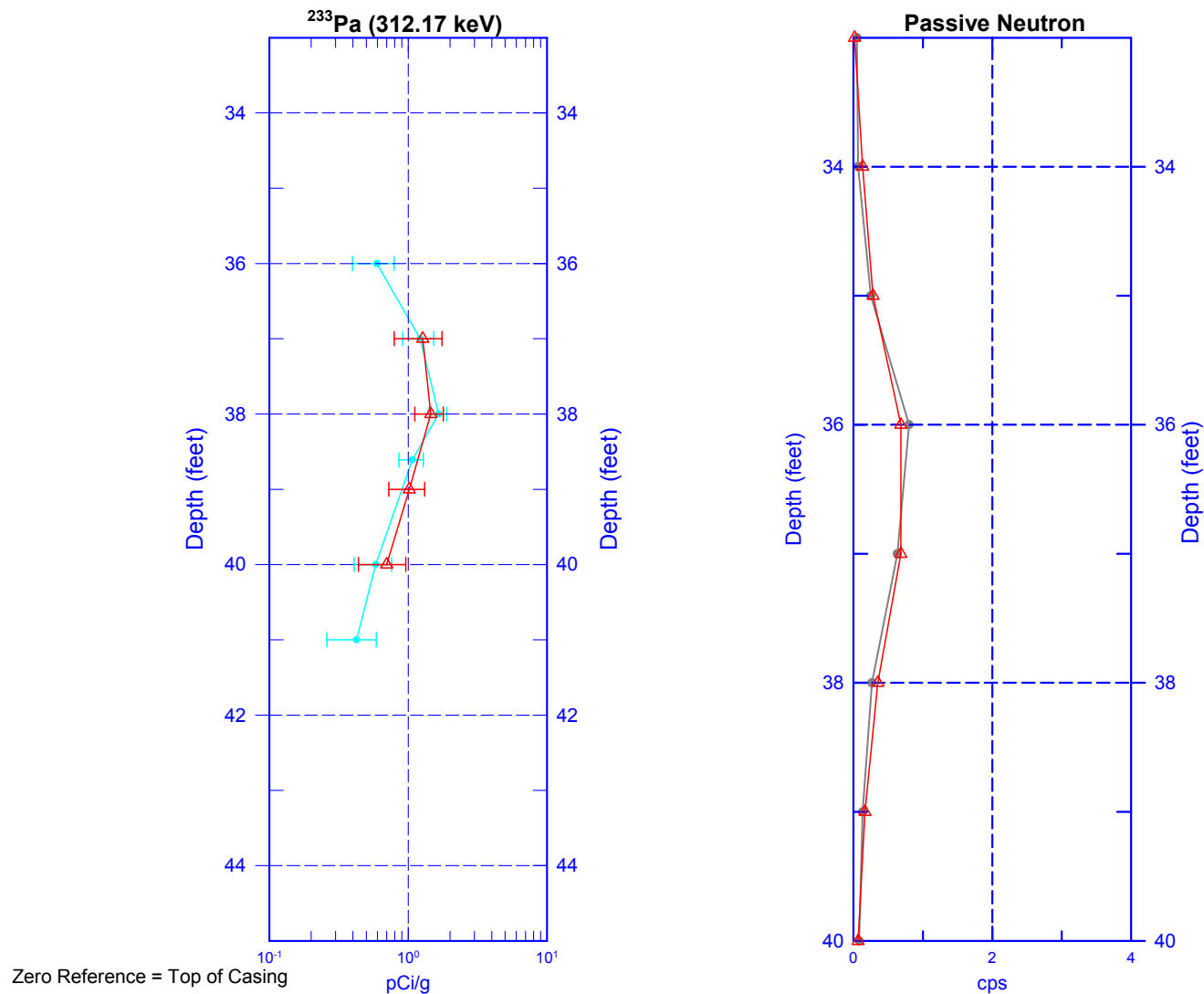


Reference - Top of Casing

## 299-W18-169 (A7651) SGLS/RLS Manmade Comparison Plot

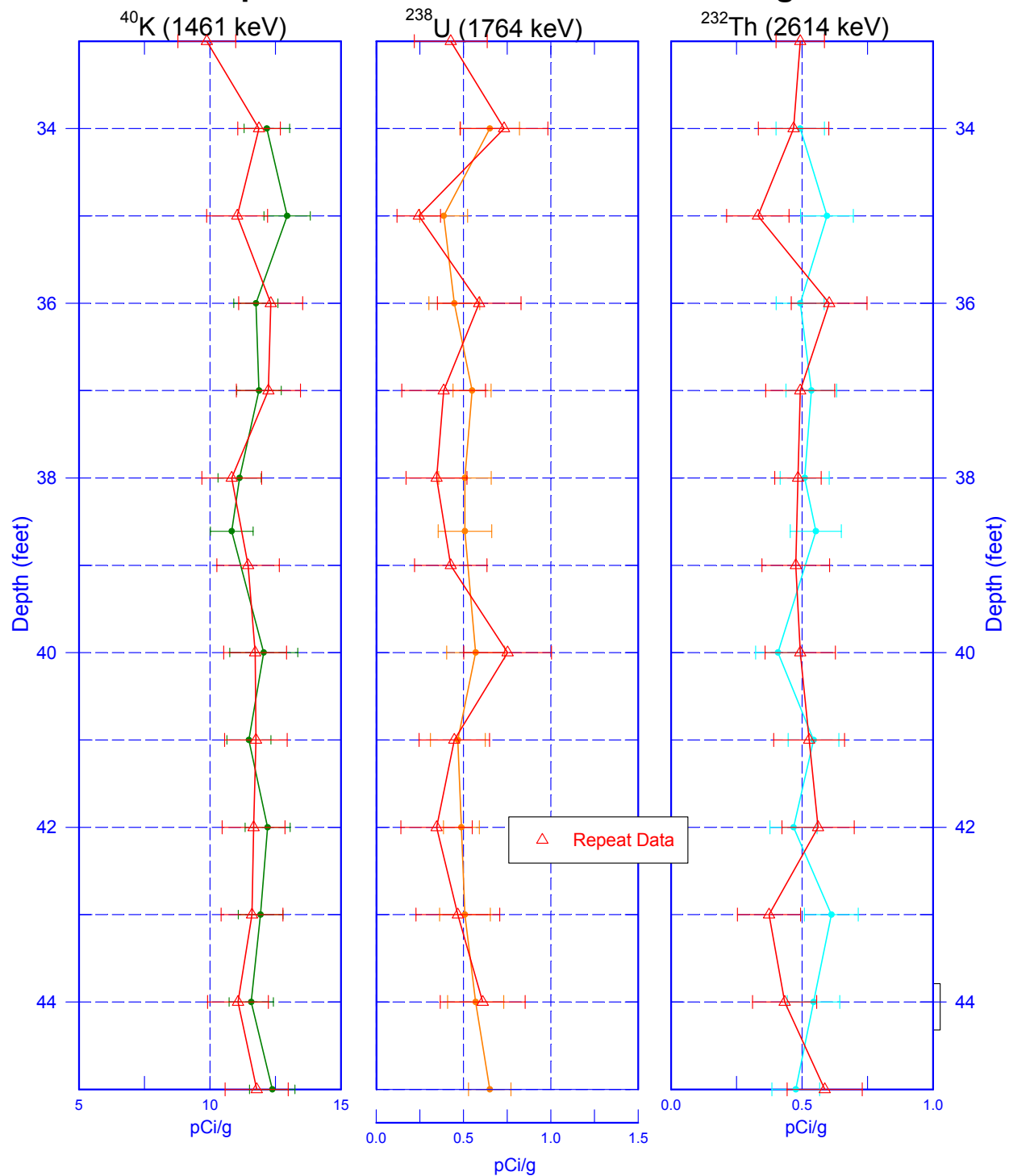


## 299-W18-169 (A7651) Repeat Section of Man-made Radionuclide



## 299-W18-169 (A7651)

### Repeat Section of Natural Gamma Logs



Zero Reference = Top of Casing